

CLAIMS:

1. A method for use in a digital ink-jet printer, the method comprising:
 - (i) continuously applying a radiation-curable ink to successive locations on a substrate along a print line extending across the substrate;
 - 5 (ii) concurrently with the continuous application of the radiation-curable ink along the print line, continuously applying first curing radiation of a predetermined first intensity to the applied ink on the successive locations on the substrate along said print line, with a certain time delay, constant for all the locations on the substrate, between the applications of ink and the first curing radiation;
 - 10 (iii) applying second curing radiation of a predetermined second intensity to the locations on the substrate a certain time period, constant for all the locations on the substrate, after the application of the first curing radiation to said locations.
- 15 2. The method of Claim 1, wherein the second curing radiation is applied to the successive locations on the substrate along a print line to which the ink and the first curing radiation have previously been applied, during the application of ink and application of the first curing radiation to successive locations along a preceding print line on the substrate.
- 20 3. The method of Claim 2, wherein the second curing radiation is simultaneously applied to at least two print lines, to which the ink and the first curing radiation have previously been applied.
4. The method of any one of preceding Claims, wherein said predetermined first intensity is about 15% or less than that of said second intensity.
- 25 5. The method of any one of preceding Claims, wherein said radiation curable ink is applied to successive locations along the first and second successive print lines on the substrate in first and second opposite directions, respectively.
6. The method of Claim 5, wherein said application of the first curing radiation comprises selectively directing the curing radiation, generated by a curing

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source, to the successive locations on the print line on the substrate in the first or second opposite direction.

7. The method of any one of preceding Claims, wherein the first and second curing radiation is concurrently directed to space-apart locations on the substrate both spaced from a location to which the ink is applied, by splitting the curing radiation, generated by a single radiation source, into first and second radiation portions in a predetermined power ratio.

8. The method according to any one of preceding Claims, wherein the first and second curing radiation are of different wavelengths.

9. The method according to Claims 7 and 8, wherein said splitting is wavelength-selective.

10. The method according to any one of Claims 6 to 9, wherein said directing of the first curing radiation comprises selectively directing the first curing radiation coming from the radiation source to either one of first and second mirrors accommodated in a spaced-apart relationship along an axis of the print line at opposite sides of the print head assembly, each of the first and second mirrors being oriented to reflect radiation impinging thereon towards the location on the print line.

11. The method according to Claim 10, wherein said selectively directing comprises directing the first curing radiation coming from the radiation source to a mirror rotatable between first and second orientations of its reflective surface to face the first and second mirrors, respectively.

12. The method according to any one of Claims 7 to 11, comprising selectively directing curing radiation coming from the radiation source towards either one of first and second radiation splitting elements, each splitting the radiation impinging thereon into first and second radiation portions presenting said first and second curing radiation, the first split radiation portion propagating towards a first print line, and the second split radiation portion being reflected to propagate towards a second print line spaced-apart from the first print line along an axis perpendicular to the print line.

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13. The method according to any one of Claims 7 to 11, comprising splitting curing radiation coming from the radiation source into first and second radiation portions presenting said first and second curing radiation, and directing the first and second split radiation portions via a mirror's assembly towards first and second spaced-apart print lines on the substrate, the rotation of said rotatable mirror providing for directing the respective one of the split radiation portions of successive locations along the print line in either one of the opposite directions.

14. An ink-jet printing apparatus comprising:

- (a) a print head assembly having one or more inkjets and operable for applying radiation-curable ink onto the substrate;
- (b) a drive assembly configured and operable to provide a relative displacement between the substrate and the print head assembly in first and second opposite directions along a print line extending across the substrate, thereby enabling application of the radiation-curable ink to successive locations along the print line;
- (c) an ink curing assembly comprising a radiation source and a radiation directing arrangement, the radiation directing arrangement being accommodated in the path of the radiation coming from the radiation source and operable to selectively direct said radiation to the print line on the substrate along either one of the first and second directions during the relative displacement between the substrate and the print head assembly, the radiation directing arrangement being oriented with respect to the print head assembly so as to allow curing of the applied ink with a certain time delay, constant for all the locations on the substrate, between the application of ink and the application of curing radiation to the substrate.

15. The apparatus of Claim 14, wherein said radiation directing assembly comprises first and second radiation reflective elements accommodated symmetrically identical with respect to the radiation source and the print head assembly, and a third reflective element mounted for rotation so as to selectively reflect the curing radiation generated by the radiation source towards the first or

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second reflective element, depending on the direction of application of the ink along the print line.

16. The apparatus of Claim 15, wherein each of said first and second reflective elements is accommodated at a certain fixed distance from the print head assembly.

5 17. The apparatus of Claim 15, wherein each of said first and second reflective elements is displaceable with respect to the print head assembly along an axis parallel to the print line.

18. The apparatus of any one of Claims 15 to 17, wherein said radiation directing arrangement comprises first and second beam splitting elements
10 accommodated upstream of the first and second reflective elements, respectively, with respect to the direction of radiation propagation from the third reflective element to the respective one of the first and second reflective elements, the beam splitting element operating to split the curing radiation reflected from the third element into first and second radiation portions and directing the first radiation
15 portion to the respective one of the first and second reflective elements to be reflected to a location on a first print line on the substrate and directing the second radiation portion to a location on a second print line on the substrate upstream of the first line with respect to the direction of relative displacement of the substrate relative to the print head during printing successive lines on the substrate.

20 19. The apparatus of any one of Claims 15 to 17, wherein said radiation directing arrangement comprises a beam splitting element that is accommodated in a path of curing radiation propagating from the radiation source towards the third reflective element and operates to split the curing radiation into first and second radiation portions and direct the first radiation portion to the third reflective element
25 and direct the second radiation portion to an additional reflective element, said additional reflective element being oriented so as to reflect the radiation to one of the first and second reflective elements.

20. The apparatus of Claim 14, wherein said radiation source is mounted for rotation, said radiation directing arrangement comprising first and second radiation
30 reflective elements accommodated symmetrically identical with respect to the

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radiation source and the print head assembly, the rotation of the radiation source resulting in that the curing radiation is selectively directed towards the first or second reflective element, depending on the direction of application of the ink along the print line.

5 **21.** The apparatus of Claim 20, wherein each of said first and second reflective elements is accommodated at a certain fixed distance from the print head assembly.

22. The apparatus of Claim 20, wherein each of said first and second reflective elements is displaceable with respect to the print head assembly along an axis parallel to of the print line.

10 **23.** The apparatus of any one of Claims 20 to 22, wherein said radiation directing arrangement comprises first and second beam splitting elements accommodated upstream of the first and second reflective elements, respectively, with respect to the direction of radiation propagation from the radiation source to the respective one of the first and second reflective elements, the beam splitting
15 element operating to split the curing radiation coming from the radiation source into first and second radiation portions and directing the first radiation portion to the respective one of the first and second reflective elements to be reflected to a location on a first print line on the substrate and directing the second radiation
20 portion to a location on a second print line on the substrate upstream of the first line with respect to the direction of relative displacement of the substrate relative to the print head during printing successive lines on the substrate.

24. The apparatus of Claim 14, wherein the radiation directing arrangement is configured and operable to split the radiation coming from the radiation source into first and second curing radiation portions of predetermined intensities.

25 **25.** The apparatus of Claim 24, wherein the ink curing assembly is configured and operable to apply the first curing radiation to the substrate with a certain time delay between the application of ink and the application of the first curing radiation to the substrate constant for all the locations on the substrate, and apply the second curing radiation to the substrate a certain time period after the application of the
30 first curing radiation constant for all the locations on the substrate.

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26. The apparatus of Claim 14, wherein the drive assembly is configured and operable to provide a relative displacement between the print head assembly and the substrate in a direction perpendicular to the print line.

27. The apparatus of Claim 26, wherein the radiation directing arrangement is
5 configured and operable to split the radiation coming from the radiation source into first and second curing radiation portions of predetermined intensities and direct them onto two spaced-apart locations on the substrate both spaced from a location to which the radiation-curable ink is applied, thereby enabling application of the first curing radiation to the substrate with a certain time delay between the
10 application of ink and the application of the first curing radiation to the substrate constant for all the locations on the substrate, and providing the application of the second curing radiation to the substrate a certain time period after the application of the first curing radiation constant for all the locations on the substrate.

28. The system of any one of Claims 14 to 27, comprising a control unit
15 connectable to the print head assembly and to the ink curing assembly.

29. The system of Claim 28, wherein the control unit is preprogrammed to provide predetermined time intervals between the ink application and application of the ink curing radiation.

30. An ink-jet printing apparatus comprising:

- 20 - a print head assembly having one or more inkjets and operable for applying radiation-curable ink onto the substrate;
- a drive assembly including first drive means operable to provide a relative displacement between the substrate and the print head assembly in first and second opposite directions along a print line extending across the substrate,
25 thereby enabling application of the radiation-curable ink to successive locations along the print line, and a second drive means operable to provide a relative displacement between the print head assembly and the substrate in a direction perpendicular to the print line;
- 30 - an ink curing assembly comprising a radiation source and a radiation directing arrangement, the radiation directing arrangement being accommodated in the

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path of the radiation coming from the radiation source and being configured and operable to split said radiation into first and second radiation portions of predetermined intensities and direct them onto two spaced-apart locations on the substrate both spaced from the location to which the ink is applied, thereby providing the application of the first curing radiation to the substrate with a certain time delay between the application of ink and the application of the first curing radiation to the substrate constant for all the locations on the substrate, and providing the application of the second curing radiation to the substrate a certain time period after the application of the first curing radiation constant for all the locations on the substrate.

31. An ink-jet printing apparatus comprising:

- a print head assembly having one or more inkjets and operable for applying radiation-curable ink onto the substrate;
- a drive assembly including first drive means operable to provide a relative displacement between the substrate and the print head assembly in first and second opposite directions along a print line extending across the substrate, thereby enabling application of the radiation-curable ink to successive locations along the print line, and a second drive means operable to provide a relative displacement between the print head assembly and the substrate in a direction perpendicular to the print line;
- an ink curing assembly comprising a radiation source and a radiation directing arrangement, the radiation directing arrangement being accommodated in the path of the radiation coming from the radiation source and being configured and operable to split said radiation into first and second radiation portions of predetermined intensities and direct them onto spaced-apart locations on the substrate both spaced from the location to which the ink is applied, said radiation directing arrangement being configured to selectively direct said first radiation portion to the print line on the substrate along either one of the first and second directions during the relative displacement between the substrate and the print head assembly with a certain time delay between the application of

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ink and the application of the first curing radiation to the substrate constant for all the locations on the substrate, and direct the second curing radiation to the substrate a certain time period after the application of the first curing radiation constant for all the locations on the substrate.